



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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PO 0661 25 June 1996 (25.06.96) AU(71) Applicant (for all designated States except US): GRADUAL  
PTY. LTD. [AU/AU]; 2-8 York Street, South Melbourne,  
VIC 3205 (AU).

(72) Inventor; and

(75) Inventor/Applicant (for US only): BOYHAN, Laurence, An-  
thony [AU/AU]; 61 Glenair Street, Lower Templestowe,  
VIC 3107 (AU).(74) Agent: RYDER, Jeffrey, Alan; Callinan Lawrie, 278 High  
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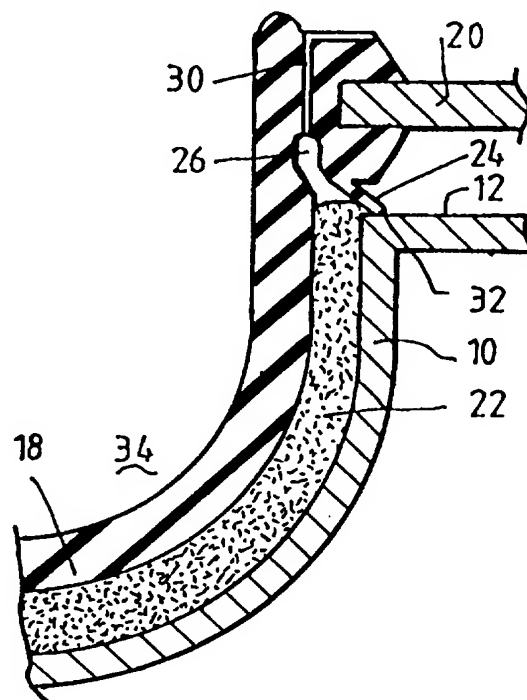
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(54) Title: ABOVE MOULD MOULDING APPARATUS AND METHOD

## (57) Abstract

The invention provides an apparatus and method for moulding a shell article in a mould where moulding above the top of the moulding plate and therefore "out of the mould" is possible. The apparatus includes a flexible forming member which is inserted into the mould cavity of a mould to displace liquid moulding material in the mould cavity into the space between the moulding surface of the mould cavity and the forming member. Surrounding each forming member is containment means which contacts the top surface of the moulding plate at the edge of the moulding cavity to contain material forced above the top of the moulding plate. A channel is provided in conjunction with the container means, the forming member or the plate carrying the forming member into which liquid moulding material which rises above the level at the top of the moulding plate enters and is contained therein by the containment means. After solidification of the liquid moulding material a shell moulded article is provided in which some part of the top rim of the article, or all of it if desired, has been moulded above the level of the moulding plate. Articles made in accordance with the apparatus and method invention are also included.



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**ABOVE MOULD MOULDING APPARATUS AND METHOD**

This invention relates to a shell moulding apparatus and method, and in particular to an apparatus and method which has the capability to mould a portion of a shell article above the mould cavity.

5           Shell moulding or moulding of shell articles is a term familiar to those skilled in this art and refers to the moulding of an article having a hollow portion thereon, more generally but not exclusively, to an article which is a relatively thin shell of material formed in a desired shape and having a partly enclosed interior volume, an  
10       interior surface and an exterior surface.

          The invention preferably relates to apparatus and a method of producing shell articles which is operated and conducted at atmospheric pressure, and, in which a liquid is provided to a mould cavity and a forming member is inserted into the cavity to displace  
15       the liquid therein into the space which remains between the mould cavity and the forming member after the forming member is in its final moulding position.

          Such apparatus is disclosed and discussed in US Patent No. 5,558,895 filed by the inventor herein and assigned to the applicant  
20       of the present invention.

          There is a perceived need in the shell moulding art to provide an apparatus and method for shell moulding articles which leaves the top surface of the moulding plate, which carries a plurality of mould cavities, clean and free of any residue or spill of the  
25       moulding material used in the process; which provides a raised rim on the inside of the top edge of the moulded article, which is useful in joining shell moulded articles together in a subsequent operation; and/or which provides a small raised bead on the top edge of the moulded article. Such a bead can be useful in retaining a

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subsequently provided amount of liquid material within the walls of the article and to seal and enclose the interior portion thereof, after the shell has been provided with a different filling material.

5 There is also a perceived need to provide an apparatus and a method for producing a decorative edge to the rim of a shell moulded article, such as a scalloped edge, above the level of the mould cavity in which the article is formed.

It is an object of the present invention to substantially meet the above stated needs, in a commercially acceptable manner.

10 The present invention is applicable to flexible, that is to say, collapsable and otherwise deformable, forming members.

According to the invention there is provided an apparatus for moulding a shell article in a mould, said apparatus including, a moulding plate having a top surface and containing one or more  
15 mould cavities therein, each of said mould cavities having a moulding surface; means to deposit liquid moulding material into said one or more mould cavities; one or more flexible forming members carried on a former plate; said flexible forming members and former plate being movable between an initial position and a final moulding  
20 position and being adapted to co-operate with the or each mould cavity by insertion of the flexible forming member thereinto, whereby to displace the deposit of liquid at the bottom of the mould cavity into the space between the flexible forming member and the moulding surface; containment means around each of said forming  
25 members associated with said former plate; said containment means being constructed and arranged to contact the top surface of the moulding plate at least at the edge of the mould cavity into which the flexible forming member is inserted, before the flexible forming

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member is in its final moulding position and before moulding material is displaced above the level of the mould cavity; said containment means remaining in sealing contact with the top surface of the mould plate while the flexible forming member moves to said final moulding position; said former plate or said flexible forming member being  
5 provided with at least one channel vented to the atmosphere; said channel being able to receive liquid moulding material which rises above the top surface of the moulding plate during positioning of the flexible forming member in said final moulding position.

10 In one aspect of the invention a portion of said containment means other than that which initially contacts the top surface of the moulding plate abuts said top surface of said moulding plate, at least up to the edge of the moulding cavity, whereby no moulding material may contact the top surface of the moulded plate.

15 In a preferred embodiment of this aspect of the invention the portion of said containment means which abuts the top surface of the moulding plate at least up to the edge of the mould cavity, also extends slightly across the opening of the mould cavity whereby to provide a clean outside edge to the shell article being moulded, and,  
20 whereby to hold the formed shell article in the mould during removal of said flexible forming member from said mould cavity, until such time as the containment means is moved off the moulding plate.

In another aspect of the invention the containment means is in the form of a ring around the periphery of each flexible forming  
25 member.

In a further aspect of the invention the containment means is in the form of a plate through which each of the forming members extend, attached to the underside of the former plate by means

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which allow up and down motion of the containment means relative to the former plate, such as, by mean of pins which retain the containment means on the former plate, but which allow the containment plate to move a pre-determined distance off the  
5 underside of the former plate under the effect of gravity.

In a still further aspect of the invention, said at least one channel is a single channel which extends around the circumference of each of said forming members.

In another embodiment of this aspect of the invention the  
10 channel is angled towards the interior of the shell article being formed, whereby to form a raised section on the inside of the top lip of the shell article.

It is preferred that the apparatus of the invention is operated at ambient pressure.

15 It is also preferred that the channel or channels provided adjacent said flexible forming member are vented into the atmosphere by means of more than one vent per channel.

The number of vents being selected after considerations which include the size of the shell article being moulded, the  
20 complexity of the shape of the article, the nature of the moulding material, and other relevant factors.

The venting of the channel is also useful when a forming member which is collapsable under reduced internal pressure is employed in the invention. When reduced pressure is applied to the  
25 interior of such a forming member the vent in the channel or channels allow air to enter the space created by collapse of the forming member away from the surface of the shell moulded article.

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The person skilled in the Art will appreciate that this supply of air is necessary if the flexible forming member is to be able to be removed from the moulded article.

5 Likewise, as again will be readily appreciated by those skilled in this art, venting of the channel or channels is useful when moulding material flows into the channel or channels as the forming member assumes its final moulding position, by avoiding any build-up in pressure in said channel or channels as the moulding material enters.

10 A number of particularly preferred embodiments of the invention will now be described with particular reference to the accompanying drawings, in which:

Fig. 1 is a cross-sectional view of moulding apparatus according to the invention shown during the forming of a shell article;

15 Fig. 2 is a cross-sectional view of one part of the apparatus shown in Fig. 1 at a further stage in the moulding process;

Fig. 3 is a cross-sectional view similar to Fig. 2, but shown with the apparatus in the final moulding position;

20 Fig. 4 is a cross-sectional view of part of apparatus according to the invention in which a modification is made to the resulting shape of the top rim of the shell article;

Fig. 5 is cross-sectional view of part of the top of a second embodiment of a former plate used in accordance with the apparatus of the invention;

25 Fig. 6 is a cross-sectional view similar to Fig. 1, but showing a third embodiment of a former plate used in accordance with the apparatus of the invention.

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Fig. 7 is a cross-sectional view of part of the apparatus shown in Fig. 6 at a further stage in the moulding process; and

Fig. 8 is a cross-sectional view similar to Fig. 7, but shown with the apparatus in the final moulding position.

5 All figures in the drawings show the apparatus of the invention schematically.

Referring to Fig. 1 of the drawings, there is seen in cross-section part of a moulding apparatus in accordance with the invention which comprises a moulding plate 10 having a top surface 12. A mould cavity 14 is provided which has a moulding surface 16.

The apparatus also consists of a flexible forming member 18 carried on a former plate 20. Forming member 18 is deformable, being formed from a flexible material such as a food grade resilient polymer, rubber or a silicone rubber material.

15 Liquid moulding material 22 was provided in the bottom of mould cavity 14 in an earlier stage of the process of the invention not illustrated in these drawings. Forming member 18 and former plate 20 have already been lowered and forming member 18 has entered mould cavity 14 and displaced liquid moulding material 22 there around. At the point in the moulding process shown in Fig. 1, forming member 18 is not yet in its final position but close to it, so that it has displaced liquid moulding material 22 so that it occupies most of the space remaining between moulding surface 16 and forming member 18.

25 At the top of forming member 18 there is provided containment means 24 in the form of an outwardly directed flexible skirt which surrounds mould cavity 14.



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Containment means 24 has a lower edge 32 and a face 25 which eventually contacts the top surface 12 of moulding plate 10.

A circumferential channel 26 which is vented to the surrounding atmosphere through vents 28 and 30 is provided in flexible forming member 18 adjacent former plate 20.

Referring now to Fig. 2, and it will be seen that forming member 18 has moved further into mould cavity 14 displacing more liquid moulding material 22 throughout mould cavity 14 and that the lower edge 32 of containment means 24 has contacted the top surface 12 of moulding plate 10. This occurs before liquid moulding material 22 rises above the level of top surface 12 so that no liquid moulding material escapes onto top surface 12 beyond containment means 24.

Referring now to Fig. 3 where forming means 18 is in its final moulding position, it can be seen that containment means 24 now has a substantial portion of face 25 thereof abutting top surface 12 and that with the slight further movement of forming member 18 into forming cavity 14 from the position shown in Fig. 2 the level of liquid moulding material 22 has risen higher above top surface 12 and has been directed into channel 26 as it is contained within containment means 24.

Forming member 18 remains in this position until liquid moulding material 22 has solidified or at least substantially solidified.

As is known in this art, forming member 18 may be removed from mould cavity 14 by application of vacuum to the interior of thereof 34, which deforms forming member 18 away from the solidified moulding material 22. As will be appreciated by those skilled in the art, because of its deformability, forming member 18 is

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able to be removed without damaging the moulded article by shrinking completely away from the article, prior to forming member 18 and support member 20 being lifted clear of moulding plate 10.

5 As will be seen from Fig. 3 by having at least a portion of containment member 24 abut top surface 12 and slightly extend into moulding cavity 14 there is produced a clean sharp outside edge 36 on the top edge of the moulded article.

Referring now to Fig. 4 there is shown an embodiment of the process and apparatus described in Figs. 1-3, in which a slightly  
10 modified shape is provided to the top edge of the moulded article. There is seen similar components which carry similar numbering. In particular there is seen a mould cavity 114 into which a forming member 118 is provided and shown in its final moulding position. Containment means 124 performs a similar function as illustrated in  
15 Figs. 1-3, but has a different configuration to provide an annular bead 138 on the top edge of the moulded article. Channel 126 performs the same function as channel 26 and is similarly vented at 130.

Referring now to Fig. 5 which is a cross-sectional view of the top of one side of a forming member and former plate as seen in  
20 Figs. 1-3 there is shown a modification of part of the apparatus of the invention, in which, (using corresponding numbering to Figs. 1-3) a forming member 218 attached to former plate 220, includes containment means 224 in the form of a peripheral ring projecting downwardly from former plate 220 and which is urged into a lower  
25 position by spring means 240.

As seen in Fig. 5 the bottom of containment means 224 has just contacted top surface 212 of moulding plate 210. As forming member 218 moves into its final moulding position, which is lower

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into mould cavity 214, containment means 224 will recede into cavity 242. Liquid moulding material 222 will be displaced past containment means 224 and into channel 226.

5 The shell article formed from the apparatus of Fig. 5 closely resembles the final product produced in accordance with the apparatus shown in Figs. 1-3. The purpose of Fig. 5 being to show a modification of the containment means which is included within the present invention.

10 Referring now to Fig. 6 there is shown a further embodiment of the apparatus and process described in Figs. 1-3, in which the containment means is provided in the form of a "floating" plate.

Again, similar components in Figs. 6, 7 and 8 carry similar numbering as that used in Figs. 1-3.

15 In Fig. 6 there is shown a mould cavity 314 into which a flexible forming member 318 is being inserted. Mould cavity 314 contains liquid moulding material 322 previously deposited.

Containment means 324 is provided in the form of a plate which is secured to former plate 320 by a plurality of pins 344  
20 having head portions 346, which prevent containment means 324 from detaching from former plate 320.

Containment means 324 is recessed so that pin heads 346 are recessed within containment means 324 when gravity forces containment means 324 to the end of pins 344, as shown in Figs. 6  
25 and 7.

As seen in Fig. 7, as forming member 318 and former plate 320 come together with moulding plate 310, liquid moulding material 322 is forced around mould cavity 314. Fig. 7 represents the point in

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the process where containment means 324 has just contacted the top surface 312 of moulding plate 310.

It will be seen that a channel 326 has been formed between containment means 324 and forming member 318 around forming member 318 and referring now to Fig. 8, it will be seen that liquid moulding material 324 has risen above the top of mould cavity 314 and entered channel 326 in the final moulding position.

Venting channels (not seen) are provided as grooves in the top of containment plate 324 or in the underside of former plate 320, or both.

While the invention is particularly suitable for moulding liquid materials which solidify upon cooling to ambient temperature, the apparatus may be equally employed where additional heating or cooling means are provided in or to the mould, in connection with the forming means or otherwise. Also the flexible forming means may have positive fluid pressure provided thereto during the moulding process to assist in retaining the desired shape of the flexible forming member.

Further, the invention may be employed with thermo-setting moulding materials, or, liquid moulding materials which solidify as a result of any other chemical reaction.

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## CLAIMS

1. Apparatus for moulding a shell article in a mould, said apparatus including, a moulding plate having a top surface and containing one or more mould cavities therein, each of said mould  
5 cavities having a moulding surface; means to deposit liquid moulding material into said one or more mould cavities; one or more flexible forming members carried on a former plate; said flexible forming members and former plate being movable between an initial position and a final moulding position and being adapted to co-operate with  
10 the or each mould cavity by insertion of the flexible forming member thereinto, whereby to displace the deposit of liquid at the bottom of the mould cavity into the space between the flexible forming member and the moulding surface; containment means around each of said forming members associated with said former plate; said containment  
15 means being constructed and arranged to contact the top surface of the moulding plate at least at the edge of the mould cavity into which the flexible forming member is inserted, before the flexible forming member is in its final moulding position and before moulding material is displaced above the level of the mould cavity; said containment  
20 means remaining in sealing contact with the top surface of the mould plate while the flexible forming member moves to said final moulding position; said former plate or said flexible forming member being provided with at least one channel vented to the atmosphere; said channel being able to receive liquid moulding material which rises  
25 above the top surface of the moulding plate during positioning of the flexible forming member in said final moulding position.

2. Apparatus as claimed in claim 1 wherein said containment means is, at least partly, a downwardly directed flexible skirt.

30 3. Apparatus as claimed in claim 1 wherein said containment means is in the form of a plate through which each forming member extends attached to said former plate.

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4. Apparatus as claimed in claim 1 wherein said containment member is in the form of a downwardly urged peripheral ring capable of receding into a portion of said former plate or said forming member during the final portion of the moulding process.

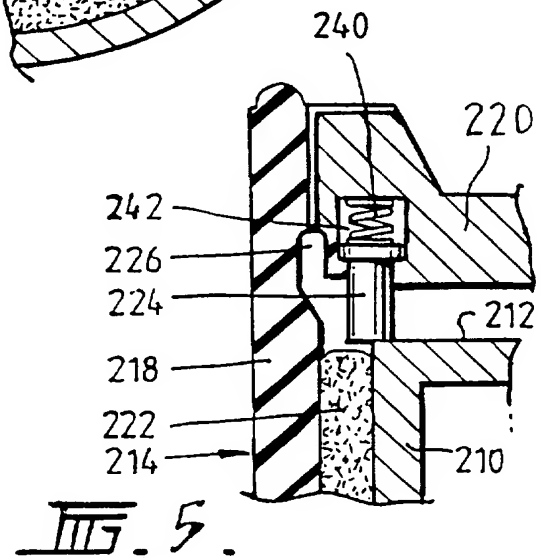
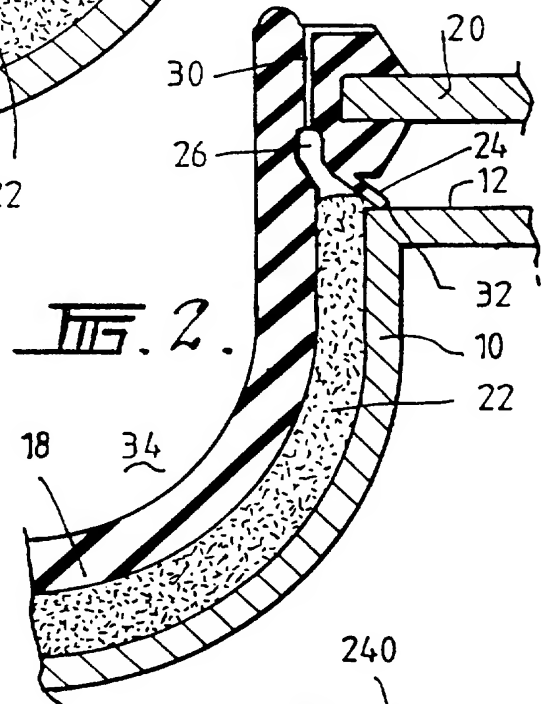
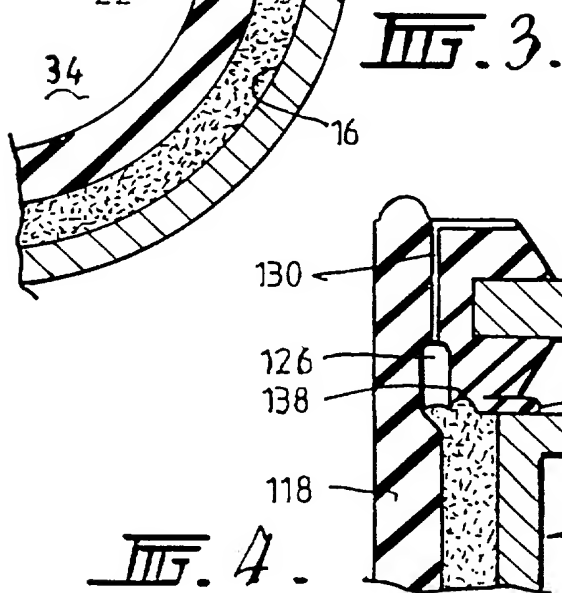
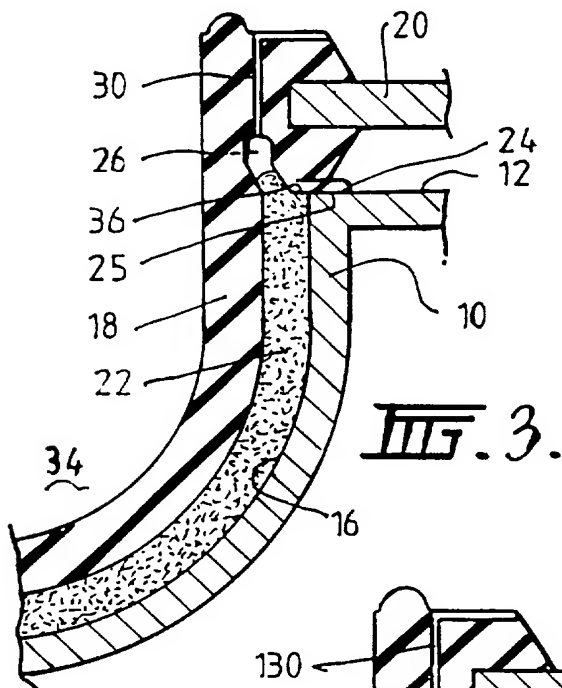
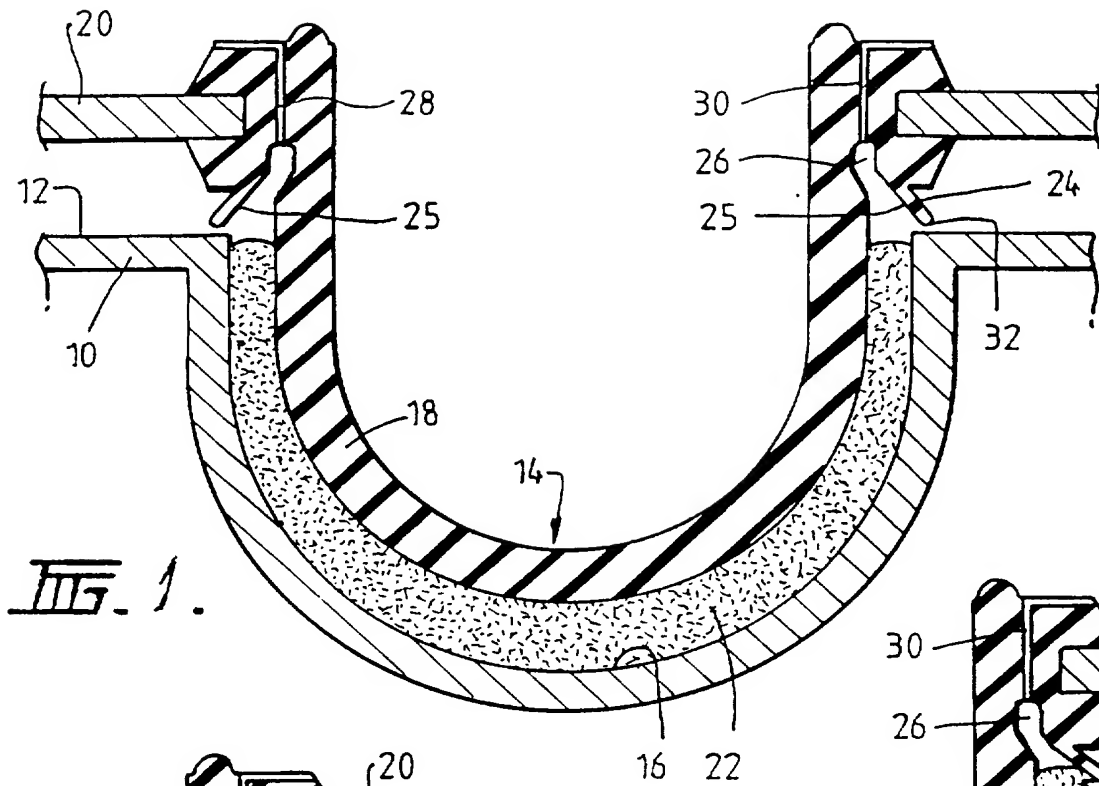
5 5. Apparatus as claimed in claim 1 wherein one channel is provided which extends around the periphery of the flexible forming member.

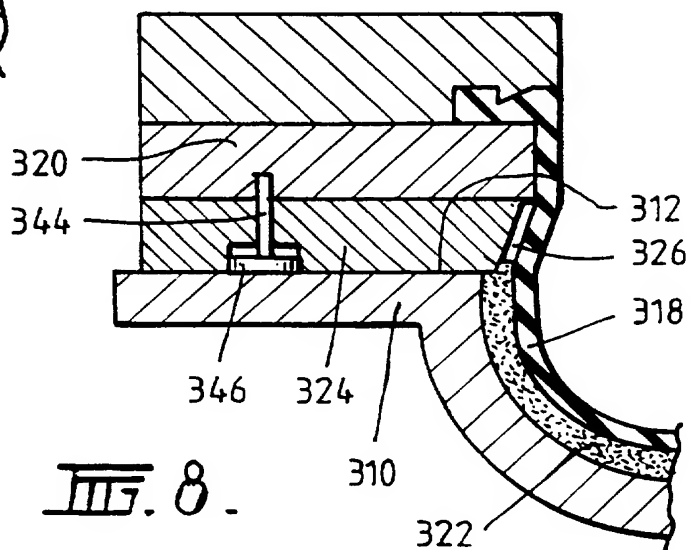
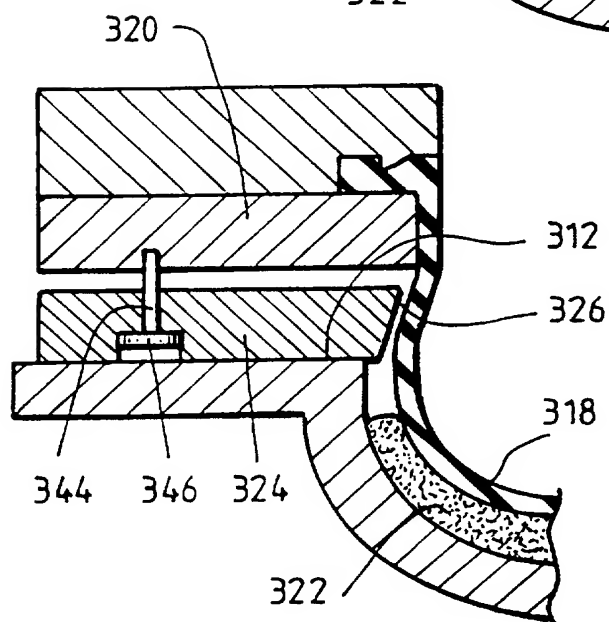
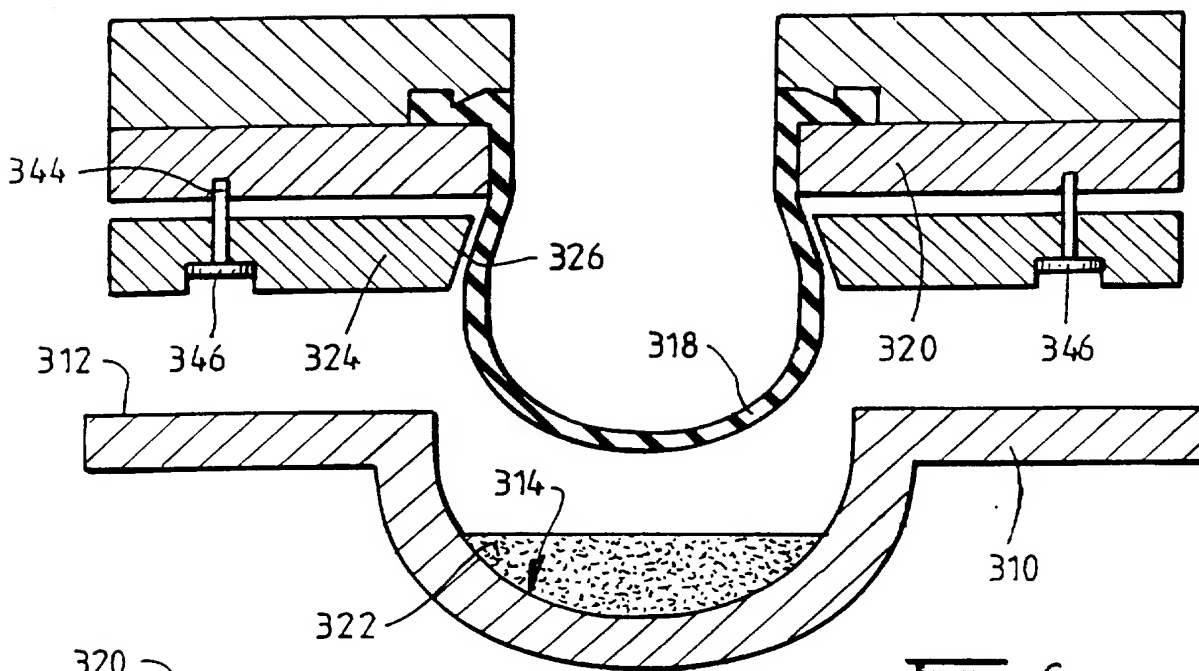
6. Apparatus as claimed in claims 1 or 5 wherein the channel is shaped to give a scalloped shape to the edge of the  
10 moulded article.

7. A method of moulding a shell article in a mould by means of the apparatus claimed in claim 1 comprising the steps of:

- (a) introducing liquid moulding material into each of said mould cavities;
- 15 (b) moving said flexible forming members into each of said mould cavities whereby to displace said liquid moulding material into the space between the forming member and the moulding surface of said mould cavities until the final moulding position is achieved;
- 20 (c) allowing said liquid moulding material to solidify or substantially solidify; and
- (d) withdrawing said flexible forming members from said mould cavities.

25







<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
Int Cl <sup>6</sup> : A23G 1/21, A23P 1/10, B29C 33/10, 33/42, 33/50		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) A23G 1/21, 1/22, 3/12, 3/18, A23P 1/00, 1/10, B29C 1/12, 1/13, 5/00, 33/10, 33/42, 33/44, 33/46, 33/48, 33/50, 39/28		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched NIL		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DERWENT WPAT, JAPIO. IPC AS ABOVE WITH KW mold: or mould: edge: or lip: or rim, or skirt: or shoulder: or flange, flexib: or resilien: or elastic:, vent: or channel: or duct: or airway		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 5558895 (BOYHAN) 24 September 1996 whole document	1-7
A	US, A, 5087193 (HERBERT, Jr) 11 February 1992 whole document	1-7
A	Derwent Abstract Accession No. 86-194578/30, Class D13, JP, A 61-128840 (SHINNO R) 16 June 1986 whole document	1-7
<input type="checkbox"/> Further documents are listed in the continuation of Box C <span style="margin-left: 100px;"><input checked="" type="checkbox"/> See patent family annex</span>		
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Date of the actual completion of the international search 18 July 1997	Date of mailing of the international search report <i>24 July 1997</i>	
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929	Authorized officer <i>L.B. Welton</i> for <b>M. BREMERS</b> Telephone No.: (02) 6283 2052	

### Information on patent family members

**PCT/AU 97/00401**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	5558895	AU WO	668135 9315613	EP	695126	US	5558895

END OF ANNEX

**PUB-NO:** WO009749296A1  
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AND METHOD  
**PUBN-DATE:** December 31, 1997

**INVENTOR-INFORMATION:**

<b>NAME</b>	<b>COUNTRY</b>
BOYHAN, LAURENCE ANTHONY	AU

**ASSIGNEE-INFORMATION:**

<b>NAME</b>	<b>COUNTRY</b>
GRADUAL PTY LTD	AU
BOYHAN LAURENCE ANTHONY	AU

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B29C033/42 ,  
B29C033/50

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A23G001/22 ,  
A23G003/02 ,  
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B29C033/10 ,  
B29C043/12 ,  
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A23P001/10

## **ABSTRACT :**

CHG DATE=19990617 STATUS=O>The invention provides an apparatus and method for moulding a sheel article in a mould where moulding above the top of the moulding plate and therefore "out of the mould" is possible. The apparatus includes a flexible forming member which is inserted into the mould cavity of a mould to dispalce liquid moulding

material in the mould cavity into the space between the moulding surface of the mould cavity and the forming member. Surrounding each forming member is containment means which contacts the top surface of the moulding plate at the edge of the moulding cavity to contain material forced above the top of the moulding plate. A channel is provided in conjunction with the container means, the forming member or the plate carrying the forming member into which liquid moulding material which rises above the level at the top of the moulding plate enters and is contained therein by the containment means. After solidification of the liquid moulding material a shell moulded article is provided in which some part of the top rim of the article, or all of it if desired, has been moulded above the level of the moulding plate. Articles made in accordance with the apparatus and method invention are also included.